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ROTHAMSTED  
RESEARCH

## Report for 1935

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## Other Experiments at Rothamsted

### Rothamsted Research

Rothamsted Research (1936) *Other Experiments at Rothamsted* ; Report For 1935, pp 174 - 193 -  
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Mean of Nitro-Chalk and Cyanamide

Year	1	2	3	4	5	6	7	8	9	10
1932										
1933										

**Conclusions**

On both mangolds and wheat the plots ploughed this year and last yielded significantly higher than the cultivated plots, the simared plots being intermediate. On the wheat similar differences appeared on the plots with rotating cultivations, but in the case of the mangolds the differences, though in the same direction, were much smaller.

In addition the shallow cultivations of the continuous part of the experiment gave lower yields than the deep cultivations, this difference being most marked on the cultivated plots and only small on the ploughed plots. No such difference appeared on the plots with rotating cultivations.

The yields of barley did not appear to be affected by the cultivations. There were no observable differences between nitro-chalk and cyanamide.

**THREE COURSE ROTATION EXPERIMENT, ROTHAMSTED, 1933  
GREEN MANURE CROPS—GREEN WEIGHTS—TONS PER ACRE**

Preceding		Manured 1932-33					Not yet manured				
		Art'ls.	Adco	St. 1.	St. 2	Mean	Art'ls.	Adco	St. 1	St. 2	Mean
Sugar Beet	Vetches	0.55	0.65	0.56	0.70	0.62	0.49	0.84	0.62	0.58	0.63
	Rye	1.02	0.78	0.75	0.92	0.87	1.29	1.08	0.78	1.11	1.06
Potatoes	Vetches	0.32	0.27	0.34	0.41	0.34	0.38	0.35	0.28	0.33	0.34
	Rye	0.54	0.76	0.30	0.67	0.57	0.63	0.47	0.62	0.52	0.56
Barley ..	Vetches	0.26	0.20	0.14	0.20	0.20	0.19	0.24	0.16	0.24	0.21
	Rye	0.37	0.40	0.22	0.40	0.34	0.74	0.30	0.44	0.44	0.48

NOTE: These figures were omitted from the 1933 report and are included here for the sake of completeness.



## WHEAT

### Effect of sulphate of ammonia applied at five different times.

RW—Gt. Harpenden, 1935.

Plan and yields in lb., grain above, straw below.

	<b>4</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>5</b>	
	77.2	88.0	89.7	92.6	72.1	76.2	
	166.0	147.9	184.9	188.4	197.4	181.8	
	<b>3</b>	<b>4</b>	<b>0</b>	<b>5</b>	<b>1</b>	<b>2</b>	
	93.2	95.8	94.1	93.9	91.6	67.3	
	190.8	193.0	168.0	198.8	191.8	197.1	
W ↑	<b>5</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>0</b>	<b>1</b>	
	90.2	87.0	86.1	85.5	93.4	68.5	
	169.2	185.6	185.8	205.2	184.8	180.8	
	<b>2</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>4</b>	
	72.5	76.7	96.3	95.3	95.9	78.2	
	188.5	191.8	174.0	172.4	189.8	168.3	
	<b>0</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>3</b>	
	84.2	96.5	98.5	81.6	90.1	81.8	
	161.1	185.0	177.8	201.7	191.1	168.0	
31	<b>1</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>0</b>	36
	77.0	91.9	95.1	86.3	82.8	60.5	
	168.0	170.6	170.0	190.5	188.4	134.8	

SYSTEM OF REPLICATION : 6×6 Latin square.

AREA OF EACH PLOT : 1/40 acre (63.5 lks. × 39.4 lks.)

TREATMENTS : No sulphate of ammonia (0) and sulphate of ammonia at the rate of 0.4 cwt. N per acre, applied on Oct. 26 (1), Jan. 19 (2), Mar. 18 (3), Apr. 27 (4) and May 24 (5).

CULTIVATIONS, ETC. Ploughed : Sept. 15-20. Harrowed : Oct. 24. Drilled : Oct. 26. Harrowed : Oct. 27. Harvested : Aug. 8 and 9. Variety : Victor. Previous crop : Beans.

STANDARD ERRORS PER PLOT : Grain : 2.35 cwt. per acre or 7.67% ; Straw 2.63 cwt. per acre or 4.08%.

### Summary of results : cwt. per acre.

	Dates of application of sulphate of ammonia (0.4 cwt. N per acre)						Mean of all N.	St. error
	No N	Oct. 26	Jan. 19	Mar. 18	Apr. 27	May 24		
GRAIN (±0.960)	30.7	31.1	28.6	29.5	31.1	32.5	30.6	±0.429
Incr. (±1.36)		+0.4	-2.1	-1.2	+0.4	+1.8	-0.1	±1.05
STRAW (±1.07)	57.7	64.8	68.2	66.9	65.1	64.8	66.0	±0.478
Incr. (±1.51)		+7.1	+10.5	+9.2	+7.4	+7.1	+8.3	±1.17

### Conclusions

The average response to sulphate of ammonia was significant for straw, but negligible for grain. The differences due to date of application were not significant in grain ; in straw, however, where the yields rose to a maximum and fell again, the parabolic regression of yield on time of application was significant.



## WHEAT

### EFFECT OF SOIL FUMIGATION

### ON THE YIELD OF SPRING OATS

### RO—PASTURES, 1935

**Soil fumigation experiment. Effect of "cymag," carbon disulphide jelly, chlordinitrobenzene and "seekay"**

Plan and yields in lb., grain above, straw centre, weeds below

		<b>O</b>	<b>2CK</b>	<b>1N</b>	<b>1CM</b>	<b>2CM</b>	<b>2S</b>	<b>2CK</b>	<b>O</b>	
	1	8.0	0.5	5.1	29.4	28.0	27.8	1.1	13.8	40
		9.1	0.4	6.7	39.3	50.9	49.8	2.7	31.4	
		52.1	0.1	14.4	6.8	2.1	0.6	3.7	17.8	
		<b>1S</b>	<b>O</b>	<b>O</b>	<b>2CM</b>	<b>1CK</b>	<b>1N</b>	<b>1CM</b>	<b>O</b>	
		33.1	23.6	9.1	32.2	0.6	9.8	23.1	11.2	
		49.9	35.6	19.1	45.0	2.1	17.9	40.0	22.3	
		3.5	13.5	53.5	4.2	1.3	17.3	11.7	34.0	
		<b>2S</b>	<b>1CK</b>	<b>O</b>	<b>2N</b>	<b>O</b>	<b>O</b>	<b>2N</b>	<b>1S</b>	
		28.2	0.5	19.5	11.3	9.9	20.7	8.5	21.0	
		44.7	1.0	33.6	20.0	7.2	32.0	20.9	37.7	
		6.1	3.5	29.9	4.7	44.9	17.3	5.3	20.8	
	S	<b>1CK</b>	<b>O</b>	<b>1S</b>	<b>2CK</b>	<b>2CK</b>	<b>O</b>	<b>1CK</b>	<b>1CM</b>	
		0.3	6.3	12.5	0.3	0.0	11.1	0.3	25.4	
		0.1	4.8	20.8	0.2	0.0	6.5	0.3	47.2	
		1.1	59.2	42.4	1.4	0.5	61.7	0.6	4.6	
		<b>O</b>	<b>2N</b>	<b>2S</b>	<b>1N</b>	<b>O</b>	<b>2N</b>	<b>2S</b>	<b>O</b>	
		10.6	4.1	15.8	6.3	14.4	13.2	27.9	21.5	
		12.4	6.5	23.8	15.7	30.7	28.6	42.1	33.5	
		35.4	10.4	27.6	21.3	25.4	4.4	9.4	17.2	
		<b>2CM</b>	<b>O</b>	<b>1CM</b>	<b>O</b>	<b>1S</b>	<b>1N</b>	<b>O</b>	<b>2CM</b>	
		20.4	11.6	10.7	6.6	16.8	15.2	18.1	21.9	
		33.1	25.0	22.4	11.6	43.0	29.6	31.8	53.6	
	21	19.7	40.6	43.4	59.8	15.2	11.0	27.0	1.5	36

The positions of the blocks in the field were slightly different from those shown above.

**SYSTEM OF REPLICATION :** 4 randomised blocks of 12 plots each.

**AREA OF EACH PLOT :** 1/80 acre (30 lks. × 41.7 lks.).

**TREATMENTS :** No fumigant (O), single (1) and double (2) dressings of "cymag" (CM), carbon disulphide jelly (S), chlordinitrobenzene (N) and "seekay"(CK), at the following rates of application per acre for the single dressing : 1 CM, 7.5 cwt. ; 1 S, 24.3 cwt. ; 1 N, 2.0 cwt. and 1 CK, 5.0 cwt.

**BASAL MANURING :** 1 cwt. sulphate of ammonia per acre.

**CULTIVATIONS :** Ploughed : March 21 and 22. Fumigants ploughed in. Harrowed : March 25 and 26. Rolled : March 26. Drilled : March 26. Harrowed : March 27. Rolled : March 27. Harrowed : May 3. Rolled : May 3. Harvested : August 9. Variety : Marvellous. Previous crop : Spring oats.

**SPECIAL NOTE :** The ratio of weeds to total oats was determined by sampling at harvesting, two random samples being taken per plot.

**STANDARD ERRORS PER PLOT :** Grain : 3.38 cwt. per acre or 28.5% ; straw : 6.17 cwt. per acre or 30.4% ; weeds : 5.07 cwt. per acre.



**Summary of Results**

	GRAIN : cwt. per acre ( $\pm 1.69$ . Means: $\pm 1.19$ )				STRAW : cwt. per acre			
	Chlor-dinitro-benzene	Carbon disulphide jelly	"Cymag"	"Seekay"	Chlor-dinitro-benzene	Carbon disulphide jelly	"Cymag"	"Seekay"
None ..			9.6 <sup>1</sup>				15.5	
Single ..	6.5	14.9	15.8	Nil	12.5	27.0	26.6	Nil
Double ..	6.6	17.8	18.3	Nil	13.6	28.7	32.6	Nil
Mean of single and double ..	6.6	16.4	17.0	Nil	13.0	27.8	29.6	Nil

STANDARD ERROR : (1)  $\pm 0.845$ . No single standard error is applicable to the straw yields.

	WEEDS : cwt. per acre			
	Chlor-dinitro-benzene	Carbon disulphide jelly	"Cymag"	"Seekay"
None ..			26.3	
Single ..	11.4	14.6	11.9	Nil
Double ..	4.4	7.8	4.9	Nil
Mean of single and double ..	7.9	11.2	8.4	Nil

**Conclusions**

Carbon disulphide jelly and "cymag" produced significant increases in the yield of grain, "cymag" giving slightly, but not significantly, higher yields than carbon disulphide jelly. In neither case was the falling-off in response at the higher level of dressing significant. The responses were presumably due in part at least to nitrogen, the single dressings of carbon disulphide jelly and "cymag" being equivalent to 37 and 87 lb. nitrogen per acre respectively. Chlordinitrobenzene significantly decreased the yield, but there was no apparent difference between the effects of the single and double dressings. There was practically no crop on the plots receiving "seekay," due to the short interval between application of the fumigants and the drilling of the seed.

No relation was found between the yields and the numbers of cysts at the second eelworm count after eliminating treatment effects.

The results for straw were similar to those for grain.

All fumigants produced large decreases in the weight of weeds, with a further decrease with the double dressing. The crop was unusually weedy.

M



Plan and numbers of cysts per 400 gms. of soil, first count above, second below

1	<b>O</b>	<b>2CK</b>	<b>1N</b>	<b>1CM</b>	<b>2CM</b>	<b>2S</b>	<b>2CK</b>	<b>O</b>	40
	269 466	283 280	252 398	212 386	95 199	127 166	80 142	134 590	
	<b>1S</b>	<b>O</b>	<b>O</b>	<b>2CM</b>	<b>1CK</b>	<b>1N</b>	<b>1CM</b>	<b>O</b>	
	138 194	100 219	197 421	263 379	107 236	89 332	41 176	74 137	
	<b>2S</b>	<b>1CK</b>	<b>O</b>	<b>2N</b>	<b>O</b>	<b>O</b>	<b>2N</b>	<b>1S</b>	
	282 372	230 256	216 708	145 304	88 356	25 212	42 308	62 221	
	<b>1CK</b>	<b>O</b>	<b>1S</b>	<b>2CK</b>	<b>2CK</b>	<b>O</b>	<b>1CK</b>	<b>1CM</b>	
	124 268	211 505	194 433	222 408	193 292	209 352	109 132	153 454	
	<b>O</b>	<b>2N</b>	<b>2S</b>	<b>1N</b>	<b>O</b>	<b>2N</b>	<b>2S</b>	<b>O</b>	
	102 363	193 561	128 311	42 222	29 254	9 92	17 28	19 106	
	<b>2CM</b>	<b>O</b>	<b>1CM</b>	<b>O</b>	<b>1S</b>	<b>1N</b>	<b>O</b>	<b>2CM</b>	
21	162 365	191 563	107 415	67 338	23 80	19 114	44 268	48 298	36

NOTE : First count : Mar. 8. Second count : Oct. 14. Two random samples of about 100 gms. of soil each were taken per half plot.  
 STANDARD ERRORS PER PLOT (400 gms. of soil) : First count : sampling error 28.1, or 21.9%.  
 Experimental error 58.1 or 45.2%. Second count : sampling error 74.3, or 24.3%. Experimental error : 123.0, or 40.2%. Second count adjusted for first count : experimental error 84.4, or 27.6%.

Summary of results

	Second count, adjusted for first count ( $\pm 42.2$ . Means : $\pm 29.8$ )			
	Chlordini-trobenzene	Carbon disulphide jelly	"Cymag"	"Seekay"
None			374 <sup>1</sup>	
Single ..	310	270	358	201
Double ..	365	203	289	178
Mean of single and double ..	338	236	324	190

STANDARD ERROR (: ) (1)  $\pm 21.1$ .

Conclusions

Carbon disulphide jelly and "seekay" produced significant decreases in the number of cysts, the falling-off in the decrease at the higher level of dressing being small for carbon disulphide jelly and not quite significant for "seekay." The decreases due to chlordinitrobenzene and "cymag" were not significant and were significantly less than those due to the other two fumigants.



## POTATOES

Effect of dung ploughed in and applied in the bouts, and of sulphate of ammonia and minerals broadcast before bouting and applied in the bouts.  
RP—Little Hoos, 1935

Total produce in lb. above, percentage ware below

1 ↑ N 61	Dp A <sub>2</sub> N —	— A <sub>1</sub> — PK	Dp A <sub>2</sub> — PK	Dp A <sub>1</sub> —	Dp A <sub>2</sub> N —	Db A <sub>2</sub> N —	— A <sub>1</sub> — PK	Db A <sub>1</sub> —	— A <sub>2</sub> —	Dp A <sub>1</sub> —	Db A <sub>1</sub> N PK	— A <sub>1</sub> — PK	12
	284	216	272	201	174	269	154	218	120	218	187	167	
	81.7	69.9	75.2	74.9	71.3	77.1	57.5	72.7	54.6	73.2	69.5	62.3	
	Db A <sub>2</sub> N —	Dp A <sub>1</sub> N PK	Db A <sub>2</sub> N PK	— A <sub>1</sub> N —	— A <sub>2</sub> N PK	Dp A <sub>2</sub> N PK	Db A <sub>1</sub> N PK	Db A <sub>2</sub> — PK	Dp A <sub>1</sub> N PK	Db A <sub>1</sub> —	Db A <sub>2</sub> N —	Dp A <sub>2</sub> N —	
	232	326	418	130	293	314	283	249	250	204	262	221	
	76.3	82.8	82.8	58.8	72.4	78.0	76.3	76.3	79.0	74.8	78.4	71.0	
Db A <sub>1</sub> N —	— A <sub>2</sub> N PK	— A <sub>2</sub> —	Db A <sub>1</sub> — PK	Dp A <sub>1</sub> N —	— A <sub>1</sub> N —	Dp A <sub>1</sub> — PK	— A <sub>2</sub> —	Dp A <sub>2</sub> — PK	Db A <sub>2</sub> — PK	— A <sub>1</sub> N —	— A <sub>2</sub> N PK		
300	337	214	280	260	135	212	141	226	248	132	288		
78.2	78.9	68.0	77.1	77.5	50.7	71.9	55.3	71.7	75.4	45.4	70.0		
Db A <sub>2</sub> N —	Dp A <sub>2</sub> N PK	— A <sub>2</sub> N —	Dp A <sub>2</sub> —	Dp A <sub>2</sub> N —	Dp A <sub>1</sub> N PK	Dp A <sub>1</sub> —	Db A <sub>1</sub> N —	Db A <sub>1</sub> — PK	Db A <sub>1</sub> N —	— A <sub>1</sub> —	Dp A <sub>2</sub> —		
298	322	112	206	256	260	171	274	281	355	128	202		
79.2	80.9	42.8	77.7	76.2	76.5	70.5	74.1	77.9	81.1	43.4	71.0		
Dp A <sub>1</sub> — PK	Db A <sub>1</sub> —	— A <sub>1</sub> —	Db A <sub>1</sub> N PK	Dp A <sub>2</sub> — PK	Db A <sub>1</sub> — PK	— A <sub>1</sub> —	— A <sub>2</sub> — PK	Dp A <sub>2</sub> N PK	Db A <sub>2</sub> N PK	— A <sub>2</sub> N —	— A <sub>1</sub> N PK		
212	229	129	296	198	217	83	210	369	402	90	245		
75.9	73.6	54.6	77.7	72.2	69.1	36.1	68.6	82.6	83.4	28.9	72.2		
— A <sub>2</sub> — PK	Db A <sub>2</sub> — PK	— A <sub>1</sub> N PK	Dp A <sub>1</sub> N —	— A <sub>1</sub> N PK	Db A <sub>2</sub> N PK	Db A <sub>2</sub> —	— A <sub>2</sub> N —	Dp A <sub>1</sub> N —	— A <sub>2</sub> — PK	Db A <sub>2</sub> —	Dp A <sub>1</sub> — PK		
195	307	275	267	261	401	252	108	296	218	277	265		
71.8	83.1	75.3	83.9	74.9	82.5	75.2	38.0	81.2	64.0	77.4	74.7		
61												72	

SYSTEM OF REPLICATION : 6 randomised blocks of 12 plots each. Certain high order interactions partially confounded with block differences.

AREA OF EACH PLOT : 1/50 acre (63.5 lks. × 31.5 lks., 9 rows per plot, of which the 7 middle rows were harvested).

TREATMENTS : All combinations of :

Dung  
None (—)  
Ploughed in (Dp)  
In the bouts (Db)

Artificials  
broad cast  
before  
bouting (A<sub>1</sub>)  
In the bouts (A<sub>2</sub>)

Sulph. Amm.  
None (—)  
0.8 cwt. N.  
(N)

Super. and mur. pot.  
None (—)  
0.8 cwt. P<sub>2</sub>O<sub>5</sub> and 1.6  
cwt. K<sub>2</sub>O. (PK)

CULTIVATIONS, ETC. : Dung applied to Dp plots : Feb. 19. Ploughed : Feb. 19-22. Artificials applied to A<sub>1</sub> plots : March 25. Tractor cultivated : March 26. Horse cultivated : March 27. Horse rolled : April 1. Ridged : April 2 and 3. Dung applied to Db plots : April 4. Applied artificials to A<sub>2</sub> plots : April 12. Potatoes planted : April 13-15. Rolled and harrowed ridges : May 7. Harrowed ridges : May 16. Re-ridged : May 24. Grubbed : June 25. Hand-hoed : July 10-11. Earthed up : July 13-14. Lifted : October 16-18. Variety : Ally. Previous crop : Wheat. Potatoes passed through a 1½ inch riddle to determine the percentage ware.

SPECIAL NOTE : The potatoes were stored in a clamp from harvest till February, the different replicates of the treatments being bulked and arranged in random order in the clamp.

STANDARD ERRORS PER PLOT : Total produce : 0.660 tons per acre or 9.67% ; Percentage ware : 3.36.



**Summary of Results : block effects eliminated**

		No dung.		Dung.	
		No super or mur.pot.	Super and mur. pot.	No super or mur.pot.	Super and mur. pot.
TOTAL PRODUCE : tons per acre					
No sulph. amm.	Artificials broadcast before bouting .. .. .		5.36 <sup>1</sup>		6.78 <sup>2</sup>
	Artificials in the bouts ..	3.90 <sup>2</sup>	5.75 <sup>1</sup>	6.18 <sup>3</sup>	7.42 <sup>2</sup>
Sulph. amm.	Artificials broadcast before bouting .. .. .	4.02 <sup>1</sup>	7.26 <sup>1</sup>	8.14 <sup>2</sup>	7.91 <sup>2</sup>
	Artificials in the bouts ..	2.75 <sup>1</sup>	9.00 <sup>1</sup>	7.66 <sup>2</sup>	10.41 <sup>2</sup>
PERCENTAGE WARE					
No sulph. amm.	Artificials broadcast before bouting .. .. .		63.8 <sup>4</sup>		74.0 <sup>5</sup>
	Artificials in the bouts ..	52.0 <sup>5</sup>	67.5 <sup>4</sup>	74.1 <sup>6</sup>	76.2 <sup>5</sup>
Sulph. amm.	Artificials broadcast before bouting .. .. .	52.2 <sup>4</sup>	73.5 <sup>4</sup>	78.9 <sup>5</sup>	77.4 <sup>5</sup>
	Artificials in the bouts ..	36.0 <sup>4</sup>	74.4 <sup>4</sup>	77.7 <sup>5</sup>	81.2 <sup>5</sup>

STANDARD ERRORS : (1) ±0.381, (2) ±0.269, (3) ±0.190, (4) ±1.94, (5) ±1.37, (6) ±0.970. These standard errors apply to comparisons which are not confounded.

**Effect of time of application of dung**

	No Artifi- cials	Sulph. amm.		Super and mur. pot.		Sulph. amm., super and mur. pot.		Mean
		b'cast before bouting	in the bouts	b'cast before bouting	in the bouts	b'cast before bouting	in the bouts	
TOTAL PRODUCE : tons per acre (±0.381)								
Dung ploughed in	5.60 <sup>1</sup>	7.87	7.28	6.59	6.66	8.00	9.61	7.15 <sup>2</sup>
Dung in the bouts	6.76 <sup>1</sup>	8.89	7.93	7.44	7.69	7.33	11.68	8.06 <sup>2</sup>
Difference ..	+1.16 <sup>3</sup>	+1.02 <sup>4</sup>	+0.65 <sup>4</sup>	+0.85 <sup>4</sup>	+1.03 <sup>4</sup>	-0.67 <sup>4</sup>	+2.07 <sup>4</sup>	+0.91
PERCENTAGE WARE : (±1.94)								
Dung ploughed in	73.1 <sup>5</sup>	80.9	76.3	74.2	73.0	79.4	80.5	76.3 <sup>6</sup>
Dung in the bouts	75.0 <sup>5</sup>	77.8	78.2	74.7	78.3	74.5	82.9	77.0 <sup>6</sup>
Difference ..	+1.9 <sup>7</sup>	-3.1 <sup>8</sup>	+1.9 <sup>8</sup>	+0.5 <sup>8</sup>	+5.3 <sup>8</sup>	-4.9 <sup>8</sup>	+2.4 <sup>8</sup>	+0.7

STANDARD ERRORS : (1) ±0.269, (2) ±0.135, (3) ±0.381, (4) ±0.539, (5) ±1.37, (6) ±0.686, (7) ±1.94, (8) ±2.74.

**Conclusions : Yields**

Dung applied in the bouts gave consistently 0.9 tons per acre more than dung ploughed in (in November).

There was no response to sulphate of ammonia applied alone, but in the presence of phosphate and potash or dung or both there was a response of 2.1 tons per acre.

In addition to producing a response to sulphate of ammonia, dung gave increases of 3.4 tons per acre in the absence of potash and phosphate and 1.3 tons per acre in their presence.

Sulphate of ammonia, in the complete fertiliser, gave a larger response when applied in the bouts than when broadcast before bouting, the increases being 3.1 and 1.9 tons per acre respectively. This was the only large effect of time of application of the artificials.



The response to potash and phosphate depended on the other manures present in the way indicated above; in particular the response was 3.2 tons per acre in the absence of dung, and 1.1 tons per acre in the presence of dung, and was greater when the potash and phosphate were applied in the bouts than when they were broadcast before bouting.

The effects of the treatments on percentage ware were in general similar to those on yield.

**Summary of results : effect of storing in clamp**

	Artificials.	No dung.		Dung.	
		No super or mur.pot.	Super and mur. pot.	No super or mur.pot.	Super and mur. pot.
Percentage loss in weight after storing.					
No sulph. amm.	Broadcast before bouting ..	4.8	6.3	4.4	4.4
	In the bouts .. ..		2.4		5.5
Sulph. amm.	Broadcast before bouting ..	1.5	3.8	2.2	7.2
	In the bouts .. ..	1.6	1.2	6.8	6.4
Percentage good after storing.					
No sulph.amm.	Broadcast before bouting ..	95.2	90.4	92.2	94.4
	In the bouts .. ..		94.1		91.5
Sulph. amm.	Broadcast before bouting ..	94.3	90.6	93.3	87.8
	In the bouts .. ..	98.5	95.7	94.7	93.8

**Effect of time of application of dung**

	No Artificials	Sulph. amm.		Super and mur. pot.		Sulph. amm. super and mur. pot.		Mean
		b'cast before bouting	in the bouts	b'cast before bouting	in the bouts	b'cast before bouting	in the bouts	
Percentage loss in weight after storing.								
Dung ploughed in	5.4	3.2	8.5	4.5	6.9	7.4	8.3	6.2
	3.3	1.2	5.2	4.4	4.1	7.0	4.4	4.1
Dung in the bouts								
<i>Difference</i> ..	-2.1	-2.0	-3.3	-0.1	-2.8	-0.4	-3.9	-2.1
Percentage good after storing.								
Dung ploughed in	93.4	93.6	94.6	94.9	94.3	90.2	95.0	93.7
	91.0	93.0	94.8	93.8	88.7	85.4	92.5	91.3
Dung in the bouts								
<i>Difference</i> ..	-2.4	-0.6	+0.2	-1.1	-5.6	-4.8	-2.5	-2.4

**Conclusions : Storing**

The average loss in weight on storing was 4 per cent. The loss was about 2 per cent. greater where dung was ploughed in than where it was applied in the bouts. There were no other treatment effects.

About 7 per cent. of the potatoes went bad on storing. Dung increased the percentage going bad, by 2 per cent. the increase being consistently greater with dung in the bouts than with dung ploughed in. Minerals increased the percentage going bad by 0.8 per cent. Sulphate of ammonia had on the average little effect, though there are indications that the percentage going bad was higher when the sulphate of ammonia was broadcast before bouting than when it was applied in the bouts.



## SUGAR BEET

**Effect of sowing date, spacing of rows and of sulphate of ammonia  
RS—LITTLE HOOS, 1935  
Plan and yields in lb.**

		Roots Tops Sugar Plant (dirty) per cent. number				Roots Tops Sugar Plant (Dirty) per cent. number											
27	1	S <sub>15</sub>	N <sub>2</sub>	566	348	16.70	833	E ↑	2	S <sub>20</sub>	N <sub>1</sub>	522	359	16.79	527	54	
	3	S <sub>10</sub>	N <sub>2</sub>	537	482	16.50	1,378		2	S <sub>10</sub>	—	579	371	16.88	1,333		
	1	S <sub>10</sub>	N <sub>1</sub>	553	314	17.00	1,420		2	S <sub>15</sub>	N <sub>2</sub>	542	372	16.39	764		
	3	S <sub>15</sub>	—	362	244	17.05	914		1	S <sub>10</sub>	N <sub>2</sub>	686	444	16.18	1,377		
	1	S <sub>20</sub>	—	398	220	16.50	558		3	S <sub>15</sub>	—	434	286	16.88	875		
	2	S <sub>20</sub>	N <sub>2</sub>	531	400	16.79	507		1	S <sub>15</sub>	N <sub>1</sub>	626	382	16.53	799		
	2	S <sub>15</sub>	N <sub>1</sub>	493	292	17.05	789		1	S <sub>20</sub>	—	489	257	16.21	541		
	2	S <sub>10</sub>	—	501	294	16.85	1,171		3	S <sub>20</sub>	N <sub>2</sub>	458	432	16.39	530		
	3	S <sub>20</sub>	N <sub>1</sub>	425	353	16.36	510		3	S <sub>10</sub>	N <sub>1</sub>	622	453	16.39	1,424		
		3	S <sub>10</sub>	N <sub>1</sub>	522	359	16.53		1,391	3	S <sub>15</sub>	N <sub>1</sub>	585	426	16.43		855
		1	S <sub>10</sub>	—	486	265	16.79		1,453	3	S <sub>10</sub>	N <sub>2</sub>	688	648	16.42		1,399
		1	S <sub>15</sub>	N <sub>1</sub>	500	284	17.05		878	2	S <sub>20</sub>	N <sub>2</sub>	566	368	16.30		542
	1	S <sub>20</sub>	N <sub>2</sub>	527	342	15.98	566	1	S <sub>15</sub>	N <sub>2</sub>	656	436	16.10	796			
	2	S <sub>10</sub>	N <sub>2</sub>	636	466	16.79	1,315	3	S <sub>20</sub>	—	486	324	17.08	539			
	3	S <sub>20</sub>	—	477	333	16.56	513	1	S <sub>20</sub>	N <sub>1</sub>	520	298	16.36	520			
	3	S <sub>15</sub>	N <sub>2</sub>	486	486	16.59	783	1	S <sub>10</sub>	—	566	303	16.47	1,351			
	2	S <sub>15</sub>	—	448	312	16.62	836	2	S <sub>10</sub>	N <sub>1</sub>	594	344	16.33	1,348			
	2	S <sub>20</sub>	N <sub>1</sub>	499	300	16.44	531	2	S <sub>15</sub>	—	487	272	16.44	802			
	3	S <sub>20</sub>	N <sub>2</sub>	464	396	16.21	526	2	S <sub>10</sub>	N <sub>2</sub>	754	486	16.44	1,286			
	3	S <sub>10</sub>	—	460	392	16.59	1,441	3	S <sub>15</sub>	N <sub>2</sub>	578	487	16.42	859			
	2	S <sub>10</sub>	N <sub>1</sub>	516	355	16.47	1,361	3	S <sub>10</sub>	—	524	358	16.27	1,445			
	3	S <sub>15</sub>	N <sub>1</sub>	458	378	16.96	871	2	S <sub>15</sub>	N <sub>1</sub>	393	220	16.04	744			
	1	S <sub>15</sub>	—	467	261	16.30	843	1	S <sub>20</sub>	N <sub>2</sub>	484	248	16.56	549			
	2	S <sub>15</sub>	N <sub>2</sub>	520	424	16.13	688	1	S <sub>15</sub>	—	515	276	16.33	821			
	2	S <sub>20</sub>	—	440	260	16.65	556	2	S <sub>20</sub>	—	424	234	17.05	542			
	1	S <sub>10</sub>	N <sub>2</sub>	714	538	16.85	1,428	3	S <sub>20</sub>	N <sub>1</sub>	458	328	16.68	578			
1	1	S <sub>20</sub>	N <sub>1</sub>	468	313	16.70	586	1	S <sub>10</sub>	N <sub>1</sub>	624	344	16.27	1,277	28		

SYSTEM OF REPLICATION : 6 randomised blocks of 9 plots each. Certain second order interactions partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows) : 10-inch spacing : 0.02083 acre ; 15-inch spacing : 0.01875 acre ; 20-inch spacing : 0.01667 acre. Plots actually 15.2 lks. × 164.5 lks. rows.

TREATMENTS : All combinations of :

$$\left\{ \begin{array}{l} \text{March 15 (1)} \\ \text{April 18 (2)} \\ \text{May 16 (3)} \end{array} \right\} \times \left\{ \begin{array}{l} \text{10-inch (S}_{10}\text{)} \\ \text{15-inch (S}_{15}\text{)} \\ \text{20-inch (S}_{20}\text{)} \end{array} \right\} \times \left\{ \begin{array}{l} \text{None (-)} \\ \text{(0.3 cwt. N) (N}_1\text{)} \\ \text{(0.6 cwt. N) (N}_2\text{)} \end{array} \right\}$$

BASAL MANURING : 10 tons dung per acre. Superphosphate at the rate of 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre and 30% potash manure salt at the rate of 1.0 cwt. K<sub>2</sub>O per acre.

CULTIVATIONS, ETC. : Applied basal dressing of artificials : January 21. Ploughed : January 21-22. Harrowed and sulphate of ammonia applied to 1st sowing : March 14. Harrowed, rolled and drilled, 1st sowing : March 15. Rolled : March 16. Harrowed, 2nd sowing : April 13. Applied sulphate of ammonia to 2nd sowing : April 15. Harrowed : April 17. Harrowed, rolled and drilled, 2nd sowing : April 18. Harrowed, rolled, sulphate of ammonia applied and drilled, 3rd sowing : May 16. Harrowed and rolled : May 17. Hoed narrow and wide rows : May 18. Hoed narrow rows : May 23. Singled, 1st sowing : May 30. Singled, 2nd sowing : June 11-17. Hoed all wide rows : June 14. Singled, 3rd sowing : June 24-July 4. Hoed : July 8-19. Lifted : November 8-23. Variety : Kleinwanzleben E. Previous crop : Wheat.

STANDARD ERRORS PER PLOT : Roots (washed) : 0.873 tons per acre or 7.85%. Tops : 0.977 tons per acre or 11.5%. Sugar percentage : 0.288. Plant number : 2.45 thousands per acre or 5.01%. Mean dirt tare : 10 inch spacing : 0.122 ; 15 inch spacing : 0.116 ; 20 inch spacing : 0.101. There was a severe attack of Heart Rot. See p. 25.



**Yields of Separate Treatments (block effects eliminated)**

**ROOTS (washed): tons per acre**

Sowing date	Sulph. amm. per acre None			Sulph. amm. per acre 0.3 cwt. N.			Sulph. amm. per acre 0.6 cwt. N.		
	Spacing (inches)			Spacing (inches)			Spacing (inches)		
	10	15	20	10	15	20	10	15	20
March 15 ..	9.75	10.42	10.74	11.37	11.91	11.52	13.01	12.71	12.49
April 18 ..	10.22	9.69	10.48	10.08	9.63	12.36	13.39	11.02	13.06
May 16 ..	9.35	8.43	11.46	10.83	10.61	10.93	11.37	11.51	10.94

**Main effects. Interactions of sulphate of ammonia with spacing and sowing dates.**

	Spacing (inches)			Sowing Dates			Mean	Increase
	10	15	20	Mar. 15	Apl. 18	May 16		
ROOTS (washed): tons per acre ( $\pm 0.356$ . Means: $\pm 0.206$ . Increases: $\pm 0.291$ )								
0.0 cwt. N ..	9.77	9.51	10.89	10.30	10.13	9.75	10.06	
0.3 cwt. N ..	10.76	10.72	11.60	11.60	10.69	10.79	11.03	+0.97
0.6 cwt. N ..	12.59	11.75	12.16	12.74	12.49	11.27	12.17	+1.14
Mean ..	11.04	10.66	11.55	11.55	11.10	10.60	11.08	
Increase ..		-0.38	+0.51		-0.45	-0.95		
TOPS: tons per acre ( $\pm 0.399$ . Means: $\pm 0.230$ . Increases: $\pm 0.325$ )								
0.0 cwt. N ..	7.08	6.55	7.27	6.29	6.90	7.72	6.97	
0.3 cwt. N ..	7.75	7.86	8.71	7.72	7.47	9.13	8.11	+1.14
0.6 cwt. N ..	10.94	10.13	9.76	9.25	9.99	11.59	10.28	+2.17
Mean ..	8.59	8.18	8.58	7.75	8.12	9.48	8.45	
Increase ..		-0.41	-0.01		+0.37	+1.73		
SUGAR PERCENTAGE ( $\pm 0.118$ . Means: $\pm 0.0681$ . Increases: $\pm 0.0963$ )								
0.0 cwt. N ..	16.64	16.60	16.68	16.44	16.75	16.74	16.64	
0.3 cwt. N ..	16.50	16.68	16.56	16.65	16.52	16.56	16.58	-0.06
0.6 cwt. N ..	16.53	16.39	16.37	16.40	16.47	16.44	16.44	-0.14
Mean ..	16.56	16.56	16.54	16.50	16.58	16.58	16.55	
Increase ..		0.00	-0.02		+0.08	+0.08		
TOTAL SUGAR: cwt. per acre								
0.0 cwt. N ..	32.5	31.5	36.3	33.9	33.9	32.6	33.5	
0.3 cwt. N ..	35.5	35.8	38.4	38.6	35.3	35.7	36.5	+3.0
0.6 cwt. N ..	41.6	38.5	39.8	41.8	41.2	37.0	40.0	+3.5
Mean ..	36.5	35.3	38.2	38.1	36.8	35.1	36.7	
Increase ..		-1.2	+1.7		-1.3	-3.0		
PLANT NUMBER: thousands per acre ( $\pm 1.00$ . Means: $\pm 0.577$ . Increases: $\pm 0.816$ )								
0.0 cwt. N ..	65.6	45.2	32.5	48.2	45.6	49.5	47.8	
0.3 cwt. N ..	65.8	43.9	32.5	47.5	45.9	48.7	47.4	-0.4
0.6 cwt. N ..	65.5	42.0	32.2	48.0	44.2	47.4	46.5	-0.9
Mean ..	65.6	43.7	32.4	47.9	45.2	48.5	47.2	
Increase ..		-21.9	-33.2		-2.7	+0.6		



**Interaction of Spacing and Sowing Dates**

Sowing Date	Spacing (inches)			Spacing (inches)		
	10	15	20	10	15	20
ROOTS (washed) : tons per acre (±0.356)			TOPS : tons per acre (±0.399)			
March 15 .. ..	11.38	11.68	11.58	7.88	7.88	7.49
April 18 .. ..	11.23	10.11	11.97	8.27	7.51	8.58
May 16 .. ..	10.52	10.18	11.11	9.61	9.15	9.67
SUGAR PERCENTAGE : (±0.118)			TOTAL SUGAR : cwt. per acre			
March 15 .. ..	16.59	16.50	16.38	37.7	38.6	38.0
April 18 .. ..	16.63	16.44	16.67	37.3	33.3	39.8
May 16 .. ..	16.45	16.72	16.55	34.6	34.0	36.8

Sowing Date	Spacing (inches)		
	10	15	20
PLANT NUMBER : thousands per acre (±1.00)			
March 15 ..	66.4	44.2	33.2
April 18 ..	62.5	41.1	32.0
May 16 ..	67.8	45.8	32.0

**Conclusions : Yields**

Sulphate of ammonia significantly increased the yields of roots and tops and significantly decreased the sugar percentage, the net result being an increase in total sugar for the double dressing (0.6 cwt. N. per acre) of 6.5 cwt. per acre. The response in roots decreased as the width of spacing increased, the interaction between sulphate of ammonia and spacing being significant.

Apart from this and the effect on plant number, spacing produced no significant effect.

There was a significant reduction in roots and a significant increase in tops with the later sowing dates, but no effect on sugar percentage. Plant number was significantly lower at the second sowing than at the first or last.

**Bolters : First sowing date**

	Spacing (inches)			Mean	Increase
	10	15	20		
PERCENTAGE OF BOLTERS					
0.0 cwt. N ..	10.07	12.96	15.86	12.96	
0.3 cwt. N ..	12.94	19.98	27.12	20.01	+7.05
0.6 cwt. N ..	21.58	21.41	23.89	22.29	+2.28
Mean .. ..	14.86	18.12	22.29	18.42	
Increase ..		+3.26	+4.17		

	Average sugar percentage	Average weight of root lb.
Bolters .. ..	16.15	0.476
Normal .. ..	16.49	0.613

**Conclusions : Bolters**

About 18 per cent. of the plants sown at the earliest date, March 15, bolted. There was practically no bolting with the later sowings.

The average weight of a bolter was about 20 per cent. smaller than that of a good root. The sugar percentage was also slightly smaller. Sulphate of ammonia increased the percentage of bolters. The percentage also increased as the width of spacing increased.



**SUGAR BEET**

**Effects of agricultural salt, applied before winter ploughing and at sowing, of dung, of additional heavy rolling of the seed-bed, and of normal and intensive inter-row cultivation**

RS—Little Hoos, 1935

Plan and yields in lb.

	Roots (dirty)	Tops	Sugar per cent.	Plant number		Roots (dirty)	Tops	Sugar per cent.	Plant number	
78	— — — C	361	370	16.36	387	Na <sub>2</sub> D — C	535	436	16.91	530
	Na <sub>1</sub> D R —	588	444	16.83	571	Na <sub>1</sub> — — C	502	479	15.98	465
	Na <sub>2</sub> D — C	507	368	17.62	567	Na <sub>1</sub> — R —	436	394	16.44	424
	— D — —	519	404	17.26	601	— D — C	494	457	16.33	447
	Na <sub>2</sub> — — —	498	350	16.82	517	— — R C	401	390	17.14	490
	Na <sub>2</sub> D R —	526	354	17.51	563	— D R —	469	406	16.73	509
	Na <sub>2</sub> — R C	526	374	17.35	525	Na <sub>2</sub> — — —	461	402	16.65	519
	Na <sub>1</sub> — R C	519	334	17.48	527	Na <sub>2</sub> D R —	515	390	17.11	580
	— D R C	584	418	17.48	576	Na <sub>1</sub> D R C	522	371	17.14	598
	Na <sub>1</sub> — — —	557	356	17.52	527	Na <sub>2</sub> — R C	458	355	17.05	529
	Na <sub>1</sub> D — C	632	426	17.26	583	— — — —	423	375	17.02	511
	— — R —	522	443	16.84	529	Na <sub>1</sub> D — —	544	418	16.50	581
	— — — —	531	471	17.34	508	Na <sub>1</sub> — — —	497	346	17.02	539
	Na <sub>2</sub> — — C	594	444	17.18	529	Na <sub>2</sub> — — C	522	433	16.79	530
	Na <sub>1</sub> D — —	635	417	17.48	607	Na <sub>1</sub> D — C	565	416	16.96	573
	Na <sub>2</sub> — R —	556	330	16.96	466	— — R —	415	317	16.98	478
	— D — C	627	384	17.18	591	Na <sub>1</sub> D R —	529	372	17.22	539
	Na <sub>1</sub> D R C	599	386	17.46	556	— — — C	451	370	16.59	453
	Na <sub>1</sub> — — C	534	332	17.70	520	Na <sub>2</sub> D R C	488	334	16.82	543
	Na <sub>1</sub> — R —	539	326	17.12	486	— D R C	524	354	16.93	564
	— — R C	526	376	17.34	455	Na <sub>1</sub> — R C	482	340	17.66	476
	Na <sub>2</sub> D R C	591	378	17.72	529	Na <sub>2</sub> — R —	441	304	16.88	462
	Na <sub>2</sub> D — —	555	318	17.40	566	— D — —	486	370	16.53	534
55	— D R —	535	404	16.89	514	Na <sub>2</sub> D — —	498	365	17.57	534

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each. Certain high order interactions are partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows) : 1/56 acre. Plots actually 1/40 acre (17.7 lks. x 141.2 lks.).

TREATMENTS : All combinations of :

- (a) No salt (—), agricultural salt at the rate of 4 cwt. NaCl per acre applied before ploughing in winter (Na<sub>1</sub>), and agricultural salt applied before sowing (Na<sub>2</sub>).
- (b) No dung (—), and dung at the rate of 10 tons per acre applied before winter ploughing (D).
- (c) Ordinary rolling of seed-bed (—), and ordinary rolling + additional heavy rolling (R).
- (d) Normal (—), and normal + intensive inter-row cultivation with motor hoe at 10-daily intervals (C).

BASAL MANURING: 0.6 cwt. N per acre as sulphate of ammonia, applied at seeding, 1.0 cwt. K<sub>2</sub>O per acre as muriate of potash (high grade), and 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre as superphosphate applied before ploughing in winter.

CULTIVATIONS, ETC. : Applied dung : Jan. 18 and 22. Applied winter artificials : Jan. 22. Ploughed : Jan. 23-26. Cultivated : April 18. Rolled, harrowed and applied artificials : April 29. Seed sown : April 29. Rolled (heavy roll plots) : May 9. Horse hoed : June 14. Singled : June 14-17. Motor hoed "Intensive" plots : June 29, July 10 and 22. Motor cultivated "Intensive" plots : July 30 and Aug. 9. Hand hoed : July 9 and 10. Horse hoed : July 18th. Lifted : Nov. 25-29. Variety : Kleinwanzleben E. Previous crop : Wheat.

STANDARD ERRORS PER PLOT : (Roots washed) : 0.692 tons per acre or 5.98%. Tops : 0.936 tons per acre or 9.77%. Sugar percentage : 0.296. Plant number : 1.78 thousands per acre or 6.06%. Mean dirt tare : 0.1048



**Responses to Treatments**

MEAN YIELDS : Roots (washed) : 11.57 tons ; Tops : 9.58 tons ; Sugar percentage : 17.06 ;  
Total sugar : 39.5 cwt. ; Plant number : 29.4 thousands.

	Mean response	Salt		Dung		Rolling		Cultivation	
		Absent	Present	Absent	Present	Ordinary	Additional	Ordinary	Intensive
ROOTS (washed) : tons per acre									
Salt .. ..	+ 0.85 <sup>1</sup>	—	—	+1.20 <sup>2</sup>	+0.49 <sup>2</sup>	+1.19 <sup>2</sup>	+0.50 <sup>2</sup>	+0.82 <sup>2</sup>	+0.90 <sup>2</sup>
Dung .. ..	+1.23 <sup>5</sup>	+1.70 <sup>3</sup>	+1.00 <sup>4</sup>	—	—	+1.25 <sup>6</sup>	+1.22 <sup>6</sup>	+0.99 <sup>6</sup>	+1.48 <sup>6</sup>
Rolling .. ..	- 0.22 <sup>5</sup>	+0.24 <sup>3</sup>	-0.45 <sup>4</sup>	-0.20 <sup>6</sup>	-0.24 <sup>6</sup>	—	—	-0.24 <sup>6</sup>	-0.20 <sup>6</sup>
Intensive cultivation ..	+0.25 <sup>5</sup>	+0.20 <sup>3</sup>	+0.28 <sup>4</sup>	+0.01 <sup>6</sup>	+0.50 <sup>6</sup>	+0.23 <sup>6</sup>	+0.28 <sup>6</sup>	—	—
St. errors ..	(1) ±0.212, (2) ±0.300, (3) ±0.346, (4) ±0.245, (5) ±0.199, (6) ±0.282.								
TOPS : tons per acre									
Salt .. ..	- 0.41 <sup>1</sup>	—	—	-0.51 <sup>2</sup>	-0.31 <sup>2</sup>	-0.15 <sup>2</sup>	-0.67 <sup>2</sup>	-0.77 <sup>2</sup>	-0.05 <sup>2</sup>
Dung .. ..	+0.39 <sup>5</sup>	+0.26 <sup>3</sup>	+0.46 <sup>4</sup>	—	—	+0.10 <sup>6</sup>	+0.68 <sup>6</sup>	+0.52 <sup>6</sup>	+0.27 <sup>6</sup>
Rolling .. ..	- 0.64 <sup>5</sup>	-0.29 <sup>3</sup>	-0.82 <sup>4</sup>	-0.93 <sup>6</sup>	-0.35 <sup>6</sup>	—	—	-0.23 <sup>6</sup>	-1.05 <sup>6</sup>
Intensive cultivation ..	+0.26 <sup>5</sup>	-0.22 <sup>3</sup>	+0.50 <sup>4</sup>	+0.38 <sup>6</sup>	+0.14 <sup>6</sup>	+0.67 <sup>6</sup>	-0.15 <sup>6</sup>	—	—
St. errors ..	(1) ±0.287, (2) ±0.406, (3) ±0.468, (4) ±0.331, (5) ±0.270, (6) ±0.382.								
SUGAR PERCENTAGE									
Salt .. ..	+0.19 <sup>1</sup>	—	—	+0.09 <sup>2</sup>	+0.30 <sup>2</sup>	+0.25 <sup>2</sup>	+0.13 <sup>2</sup>	+0.11 <sup>2</sup>	+0.27 <sup>2</sup>
Dung .. ..	+0.11 <sup>5</sup>	-0.04 <sup>3</sup>	+0.18 <sup>4</sup>	—	—	+0.17 <sup>6</sup>	+0.05 <sup>6</sup>	+0.12 <sup>6</sup>	+0.10 <sup>6</sup>
Rolling .. ..	+0.13 <sup>5</sup>	+0.21 <sup>3</sup>	+0.09 <sup>4</sup>	+0.19 <sup>6</sup>	+0.07 <sup>6</sup>	—	—	-0.14 <sup>6</sup>	+0.39 <sup>6</sup>
Intensive cultivation ..	+0.07 <sup>5</sup>	-0.03 <sup>3</sup>	+0.13 <sup>4</sup>	+0.08 <sup>6</sup>	+0.06 <sup>6</sup>	-0.19 <sup>6</sup>	+0.34 <sup>6</sup>	—	—
St. errors ..	(1) ±0.0909, (2) ±0.128, (3) ±0.148, (4) ±0.105, (5) ±0.0857, (6) ±0.121								
TOTAL SUGAR : cwt. per acre									
Salt .. ..	+3.3	—	—	+4.2	+2.4	+4.7	+2.0	+3.0	+3.6
Dung .. ..	+4.4	+5.6	+3.8	—	—	+4.6	+4.3	+3.6	+5.2
Rolling .. ..	-0.4	+1.3	-1.3	-0.3	-0.6	—	—	-1.1	+0.2
Intensive cultivation ..	+1.0	+0.6	+1.2	+0.2	+1.8	+0.4	+1.7	—	—
PLANT NUMBER : thousands per acre									
Salt .. ..	+1.3 <sup>1</sup>	—	—	+1.4 <sup>2</sup>	+1.2 <sup>2</sup>	+2.2 <sup>2</sup>	+0.5 <sup>2</sup>	+0.4 <sup>2</sup>	+2.2 <sup>2</sup>
Dung .. ..	+3.5 <sup>5</sup>	+3.7 <sup>3</sup>	+3.4 <sup>4</sup>	—	—	+3.4 <sup>6</sup>	+3.7 <sup>6</sup>	+3.4 <sup>6</sup>	+3.6 <sup>6</sup>
Rolling .. ..	-0.5 <sup>5</sup>	+0.6 <sup>3</sup>	-1.1 <sup>4</sup>	-0.7 <sup>6</sup>	-0.4 <sup>6</sup>	—	—	-2.0 <sup>6</sup>	+0.9 <sup>6</sup>
Intensive cultivation ..	-0.3 <sup>5</sup>	-1.5 <sup>3</sup>	+0.3 <sup>4</sup>	-0.4 <sup>6</sup>	-0.2 <sup>6</sup>	-1.7 <sup>6</sup>	+1.2 <sup>6</sup>	—	—
St. errors ..	(1) ±0.546, (2) ±0.772, (3) ±0.891, (4) ±0.629, (5) ±0.514, (6) ±0.727.								



**Main effects and interactions of salt**

Salt	No Dung	Dung	Ordinary rolling	Heavy rolling	Normal cultivation	Intensive cultivation	Mean	Increase
ROOTS (washed) : tons per acre ( $\pm 0.245$ . Means : $\pm 0.173$ . Increases : $\pm 0.245$ )								
None .. ..	10.16	11.86	10.89	11.12	10.91	11.10	11.01	
Before ploughing	11.37	12.91	12.49	11.79	12.10	12.18	12.14	+ 1.13
Before sowing	11.34	11.79	11.66	11.47	11.33	11.81	11.57	+ 0.56
TOPS : tons per acre ( $\pm 0.331$ . Means : $\pm 0.234$ . Increases : $\pm 0.331$ )								
None .. ..	9.73	9.99	10.00	9.71	9.97	9.75	9.86	
Before ploughing	9.08	10.16	9.97	9.27	9.60	9.64	9.62	- 0.24
Before sowing	9.35	9.20	9.74	8.81	8.79	9.76	9.28	- 0.58
SUGAR PERCENTAGE : ( $\pm 0.105$ . Means : $\pm 0.0742$ . Increases : $\pm 0.105$ )								
None .. ..	16.95	16.92	16.83	17.04	16.95	16.92	16.94	
Before ploughing	17.12	17.10	17.05	17.17	17.02	17.20	17.11	+ 0.17
Before sowing	16.96	17.33	17.12	17.18	17.11	17.18	17.15	+ 0.21
TOTAL SUGAR : cwt. per acre								
None .. ..	34.4	40.1	36.6	37.9	37.0	37.6	37.3	
Before ploughing	38.9	44.2	42.6	40.5	41.2	41.9	41.6	+ 4.3
Before sowing	38.5	40.9	39.9	39.4	38.8	40.6	39.7	+ 2.4
PLANT NUMBER : thousands per acre ( $\pm 0.629$ . Means : $\pm 0.445$ . Increases : $\pm 0.629$ )								
None .. ..	26.7	30.4	28.2	28.8	29.3	27.8	28.5	
Before ploughing	27.8	32.3	30.8	29.2	29.9	30.1	30.0	+ 1.5
Before sowing	28.5	30.9	30.0	29.4	29.4	30.0	29.7	+ 1.2

**Conclusions**

Salt produced significant increases in the yield of roots and the sugar percentage, and a small but not significant decrease in the yield of tops. The increase in total sugar was 3.3 cwt. per acre. The increase in roots was significantly greater when the salt was applied before winter ploughing than when it was applied at sowing. This effect, however, appeared only in presence of dung, the interaction between dung and time of application of salt being significant. Otherwise there was little difference in the effects of time of application.

Dung significantly increased the yield of roots, the resultant increase in total sugar being 4.4 cwt. per acre. The increases in tops and sugar percentage were not significant.

Additional heavy rolling gave a significant decrease in tops. There were no significant differences between the effects of ordinary and intensive inter-row cultivation.

Plant number was significantly increased by salt and dung.



## SUGAR BEET

Soil fumigation experiment. Effect of chlorpicrin, chlordinitrobenzene, "seekay" and "cymag," as controls of wireworm infestation.

RS—PASTURES, 1935

Plan and yields in lb.

Roots (dirty), tops, sugar percentage and plant number in descending order

103	<b>P</b> 217 298 15.72 439	<b>O</b> 284 330 15.92 442	<b>N</b> 359 440 15.38 474	<b>K</b> 148 178 14.83 424	<b>M</b> 488 532 16.01 512	107
108	<b>M</b> 466 494 15.49 514	<b>K</b> 146 152 15.69 440	<b>O</b> 434 402 16.47 520	<b>N</b> 431 448 16.27 504	<b>P</b> 450 439 16.48 507	
	<b>O</b> 460 434 16.13 511	<b>M</b> 522 522 16.93 515	<b>K</b> 165 202 15.26 464	<b>P</b> 555 378 16.53 523	<b>N</b> 516 546 15.95 495	
	<b>N</b> 476 486 16.01 500	<b>P</b> 464 418 16.30 498	<b>M</b> 546 542 16.39 476	<b>O</b> 500 476 16.13 464	<b>K</b> 179 196 15.20 439	
123	<b>K</b> 188 213 15.06 426	<b>N</b> 386 426 15.87 444	<b>P</b> 384 375 15.78 479	<b>M</b> 458 461 16.36 486	<b>O</b> 344 306 16.21 451	127

Note: In the field the plots lay in one line, 108 being next to 107, etc.

SYSTEM OF REPLICATION: 5 × 5 Latin square.

AREA OF EACH PLOT: 1/60 acre (60.6 lks. × 27.5 lks.).

TREATMENTS: No fumigant (O), chlordinitrobenzene (N) and chlorpicrin (P) at the rate of 2.0 cwt. per acre, "cymag" (M) at the rate of 7.5 cwt. per acre and "seekay" (K) at the rate of 5.0 cwt. per acre.

BASAL MANURING: 4 cwt. superphosphate, 2 cwt. muriate of potash and 1 cwt. sulphate of ammonia per acre.

CULTIVATIONS, ETC.: Ploughed: April 26. Fumigants applied as ploughed. Harrowed: April 30. Rolled: April 30. Seed sown: April 30. Harrowed: May 2. Rolled: May 2. Singled: June 15. Hoed: June 18, 29, July 25 and 26. Lifted: November 5-8. Variety: Kleinwanzleben. Previous crop: Grass.

STANDARD ERRORS PER PLOT: Roots (washed): 0.953 tons per acre or 9.91%. Tops: 1.08 tons per acre or 9.22%. Sugar percentage: 0.290. Plant number: 1.18 thousands per acre or 4.11%. The "Seekay" treatment was omitted in the analysis of roots and tops, owing to its low yields. Mean dirt tare: 0.1785.



### Summary of Results

	No fumigant	Chlordinitrobenzene	Chlorpicrin	'Cymag'	'Seekay'	Mean	Standard Error
ROOTS (washed), tons per acre .. ..	8.90	9.54	9.11	10.91	3.64	8.42	±0.426*
TOPS, tons per acre ..	10.44	12.57	10.22	13.67	5.04	10.39	±0.519*
SUGAR PERCENTAGE ..	16.16	15.92	16.16	16.24	15.22	15.94	±0.130
TOTAL SUGAR, cwt. per acre .. ..	28.8	30.4	29.4	35.4	11.1	27.0	—
PLANT NUMBER, thousands per acre	28.6	29.0	29.4	30.0	26.3	28.7	±0.528

\* These standard errors are not applicable to the "Seekay" treatment.

### Conclusions : Yields

The yield of roots with "cymag" was significantly higher than that with chlorpicrin or chlordinitrobenzene, the latter yields not being significantly different from the yield with no fumigant. The response to "cymag" may be an effect of nitrogen, the dressing being equivalent to 87 lb. nitrogen per acre.

"Cymag" and chlordinitrobenzene significantly increased the yields of tops, the increases not being significantly different. There were no significant effects on sugar percentage, apart from the reduction due to "seekay."

"Seekay" gave low yields and a low sugar percentage. This was possibly because it was applied too near sowing date.

No relation was found between the yields of roots and the numbers of wireworms at the second count, after eliminating treatment effects.



**Wireworm Counts :**

Plan and number of wireworms per plot (total of six samples)  
1st count above, 2nd count below

103	<b>P</b> 6 6	<b>O</b> 6 3	<b>N</b> 20 29	<b>K</b> 34 8	<b>M</b> 19 17	107
	<b>M</b> 15 8	<b>K</b> 20 13	<b>O</b> 34 18	<b>N</b> 25 12	<b>P</b> 26 16	
	<b>O</b> 20 16	<b>M</b> 17 12	<b>K</b> 24 7	<b>P</b> 33 10	<b>N</b> 22 28	
	<b>N</b> 39 14	<b>P</b> 24 11	<b>M</b> 36 13	<b>O</b> 24 22	<b>K</b> 32 7	
123	<b>K</b> 26 7	<b>N</b> 22 26	<b>P</b> 35 24	<b>M</b> 29 14	<b>O</b> 19 20	127

Note : At the first count three random samples per half plot were taken ; at the second count two per third of a plot. Each sample consisted of 9 ins. x 9 ins. x 4 ins. (deep) of soil.

STANDARD ERRORS PER PLOT : First count : sampling error : 6.06 or 25% ; experimental error : 6.99 or 29%. Second count : sampling error : 4.87 or 34% ; experimental error : 7.18 or 50%.

**Summary of Results : Second Count**

No. of wireworms per square yard, 4 inches deep

No fumigant	Chlordini-trobenzene	Chlor-picrin	"Cymag"	"Seekay"	Mean	Standard error.
42	58	36	34	22	38	± 8.59

**Conclusions : Wireworm Counts**

The effects of the treatments on the numbers of wireworms were not significant. No relation was found between the numbers of wireworms per plot at the first and second counts, after allowing for possible treatment effects.



## BRUSSELS SPROUTS

**Effect of sulphate of ammonia, poultry manure, soot and rape dust**

FOSTER'S—RD, 1935

Plan and yields in lb. saleable sprouts  
Total of both Pickings

	1	<b>R<sub>1</sub></b> 37.0	<b>N<sub>2</sub></b> 22.5	<b>M<sub>2</sub></b> 13.5	<b>M<sub>1</sub></b> 26.5	<b>M<sub>0</sub></b> 34.5	<b>R<sub>1</sub></b> 29.0	<b>R<sub>0</sub></b> 37.5	<b>N<sub>1</sub></b> 32.5	
		<b>S<sub>2</sub></b> 41.0	<b>S<sub>1</sub></b> 25.0	<b>N<sub>1</sub></b> 12.0	<b>M<sub>0</sub></b> 17.5	<b>S<sub>0</sub></b> 21.5	<b>M<sub>1</sub></b> 34.0	<b>M<sub>2</sub></b> 41.0	<b>N<sub>2</sub></b> 35.0	
SW	↑	<b>R<sub>0</sub></b> 27.5	<b>S<sub>0</sub></b> 15.5	<b>R<sub>2</sub></b> 25.0	<b>N<sub>0</sub></b> 17.0	<b>R<sub>2</sub></b> 41.0	<b>S<sub>2</sub></b> 36.5	<b>N<sub>0</sub></b> 44.5	<b>S<sub>1</sub></b> 26.0	
		<b>R<sub>0</sub></b> 26.0	<b>N<sub>2</sub></b> 15.5	<b>M<sub>1</sub></b> 17.0	<b>S<sub>1</sub></b> 30.0	<b>R<sub>0</sub></b> 21.5	<b>R<sub>2</sub></b> 27.0	<b>R<sub>1</sub></b> 25.5	<b>M<sub>1</sub></b> 30.0	
		<b>N<sub>0</sub></b> 17.0	<b>M<sub>2</sub></b> 20.0	<b>M<sub>0</sub></b> 23.5	<b>S<sub>0</sub></b> 19.5	<b>M<sub>0</sub></b> 23.5	<b>N<sub>2</sub></b> 28.0	<b>N<sub>1</sub></b> 30.0	<b>S<sub>2</sub></b> 30.5	
		<b>R<sub>1</sub></b> 19.5	<b>S<sub>2</sub></b> 25.5	<b>R<sub>2</sub></b> 20.0	<b>N<sub>1</sub></b> 29.5	<b>S<sub>0</sub></b> 28.0	<b>N<sub>0</sub></b> 20.5	<b>S<sub>1</sub></b> 24.5	<b>M<sub>2</sub>*</b> 24.4*	
	41									48

\* Estimated.

SYSTEM OF REPLICATION : 4 randomised blocks of 12 plots each.

AREA OF EACH PLOT (after rejecting edge rows) : 0.024174 acre. Plots actually 10 yds. × 14 yds.

TREATMENTS : 1935. No nitrogen (O), sulphate of ammonia (N) half applied in seed bed and remainder as a top dressing, poultry manure (M), soot (S) and rape dust (R), applied at the rate of 0.4 cwt. N per acre (1) or 0.8 cwt. N per acre (2).

Plots receiving treatment O in 1935 had treatment 2 in 1934 and vice versa. Plots receiving treatment 1 had this in both years. For N<sub>0</sub>, S<sub>0</sub>, M<sub>0</sub> and R<sub>0</sub> (see plan), the treatment symbols refer to the 1934 treatment.

BASAL MANURING : All plots were made up to 1.0 cwt. P<sub>2</sub>O<sub>5</sub> per acre, and 1.0 cwt. K<sub>2</sub>O per acre, using superphosphate and muriate of potash (an allowance being made for the P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O contained in the organic manures).

CULTIVATIONS, ETC. : Ploughed : Mar. 5 and 6. Harrowed : Mar. 16. Ploughed : Mar. 18-20. Harrowed : May 3. Rolled : May 3. Manures applied : May 22-29. Second half of sulphate of ammonia applied : July 27. Harrowed : May 28-29. Rolled : May 30. Brussels planted : June 5-6. Hoed : July 24, 30, 31 and Sept. 16. Harvested : First picking : Nov. 19-20. Second picking : Mar. 5. Previous crop : Brussels.

STANDARD ERROR PER PLOT (total of both pickings, saleable sprouts) : 2.42 cwt. per acre or 24.8%.

SPECIAL NOTE : Owing to damage by pigeons the weights at the second picking were very small.

### Saleable Sprouts—total of both pickings : cwt. per acre (±1.21)

Nitrogen, cwt. p.a.		Sulph. amm.	Poultry manure.	Soot.	Rape dust.	Mean. (±0.605)
1934	1935					
0.8	0.0	9.1	9.1	7.8	10.4	9.1
0.4	0.4	9.6	9.9	9.7	10.2	9.8
0.0	0.8	9.3	9.1	12.3	10.4	10.3
Mean (±0.699)		9.3	9.4	9.9	10.3	9.7

### Conclusions

The experiment is designed to measure the difference in the immediate and cumulative effects of certain organic fertilisers and sulphate of ammonia. The yield was a very poor one, owing to adverse weather conditions and damage by birds. There were no significant effects.



**BEANS**

**Effect of dung, nitrochalk, superphosphate and muriate of potash, and of spacing of the rows.**

**RE—Little Hoos, 1935.**

**Plan and yields in lb., grain above, straw below.**

1  W ↑  29	<b>S<sub>1</sub>NK</b> 71.2 86.8	<b>S<sub>1</sub></b> 66.5 82.5	<b>S<sub>1</sub>P</b> 56.7 68.3	<b>S<sub>1</sub>NPK</b> 48.0 52.0	4          32
	<b>S<sub>2</sub>NP</b> 45.7 57.3	<b>S<sub>2</sub>DN</b> 70.5 93.0	<b>S<sub>2</sub>DNP</b> 64.6 82.4	<b>S<sub>2</sub>N</b> 23.3 25.7	
	<b>S<sub>1</sub>DP</b> 76.7 95.3	<b>S<sub>2</sub>PK</b> 74.3 84.7	<b>S<sub>1</sub>D</b> 74.8 97.2	<b>S<sub>2</sub>K</b> 39.3 41.2	
	<b>S<sub>2</sub>DK</b> 73.3 86.7	<b>S<sub>1</sub>DNPK</b> 77.0 112.5	<b>S<sub>1</sub>DNK</b> 73.7 104.3	<b>S<sub>2</sub>DPK</b> 56.3 71.7	
	<b>S<sub>2</sub></b> 36.2 40.3	<b>S<sub>2</sub>DP</b> 49.8 65.2	<b>S<sub>1</sub>N</b> 68.0 81.5	<b>S<sub>1</sub>K</b> 63.6 68.9	
	<b>S<sub>2</sub>NK</b> 60.5 62.5	<b>S<sub>1</sub>DK</b> 51.3 73.2	<b>S<sub>2</sub>DNK</b> 92.5 114.5	<b>S<sub>1</sub>DPK</b> 63.6 82.9	
	<b>S<sub>1</sub>NP</b> 36.3 48.7	<b>S<sub>2</sub>DNPK</b> 61.3 82.2	<b>S<sub>2</sub>P</b> 29.9 39.1	<b>S<sub>1</sub>DNP</b> 60.8 80.7	
	<b>S<sub>1</sub>DN</b> 67.3 88.2	<b>S<sub>1</sub>PK</b> 49.6 57.9	<b>S<sub>2</sub>D</b> 54.7 69.3	<b>S<sub>2</sub>NPK</b> 47.9 60.1	

SYSTEM OF REPLICATION : 4 randomised blocks of 8 plots each. Certain interactions confounded with block differences. Error estimated from high order interactions.

AREA OF EACH PLOT : 1/40 acre (68.7 lks. × 36. 4 lks.)

TREATMENTS : All combinations of :

Spacing { 18 ins. (S<sub>1</sub>) } × { 24 ins. (S<sub>2</sub>) } × 
 Dung { None } × { 10 tons (D) } × 
 Nitro-chalk { None } × { 0.4 cwt.N (N) } × 
 Superphosphate { None } × { 0.6 cwt. P<sub>2</sub>O<sub>5</sub> (P) }  
 × Muriate of Potash { None } × { 1.0 cwt. K<sub>2</sub>O (K) }

CULTIVATIONS : Dung applied : Oct. 10. Ploughed : Oct. 10-17. Artificial applied : Oct. 20. Harrowed : Oct. 22. Drilled : Oct. 22. Harrowed : Oct. 24 and Mar. 20. Nitro-chalk applied : Mar. 28. Hand hoed : May 1-7. Harvested : Aug. 6. Previous crop : Wheat.

STANDARD ERRORS PER PLOT : Grain : 3.38 cwt. per acre or 16.1%. Straw : 3.57 cwt. per acre or 13.6%.



**Responses to fertilisers : cwt. per acre.**  
**Mean yields : Grain : 21.0 cwt. ; Straw : 26.3 cwt.**

Treatment	Mean response	Differential responses									
		Spacing		Dung		Nitro-chalk		Super-phosphate		Muriate of Potash	
		18 ins.	24 ins.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
GRAIN : ( $\pm 1.69$ . Mean response : $\pm 1.20$ )											
Spacing 18 ins.											
—24 ins.	+2.8	—	—	+4.6	+1.0	+4.0	+1.6	+3.8	+1.7	+5.9	-0.3
Dung ..	+5.6	+3.8	+7.4	—	—	+3.8	+7.4	+5.8	+5.4	+7.0	+4.2
Nitro-chalk ..	+1.2	0.0	+2.4	-0.7	+3.0	—	—	+3.0	-0.7	-0.4	+2.7
Super-phosphate	-2.0	-3.0	-0.9	-1.8	-2.1	-0.1	-3.8	—	—	-1.8	-2.1
Muriate of potash ..	+2.7	-0.4	+5.8	+4.1	+1.3	+1.2	+4.2	+2.8	+2.6	—	—
STRAW : ( $\pm 1.78$ . Mean response : $\pm 1.26$ )											
Spacing 18 ins.											
—24 ins.	+4.6	—	—	+6.1	+3.1	+5.7	+3.4	+6.6	+2.5	+7.6	+1.6
Dung ..	+9.8	+8.4	+11.3	—	—	+7.1	+12.6	+10.6	+9.1	+10.2	+9.5
Nitro-chalk ..	+2.4	+1.3	+3.5	-0.4	+5.2	—	—	+4.3	+0.5	0.0	+4.8
Super-phosphate	-1.7	-3.8	+0.4	-0.9	-2.4	+0.2	-3.6	—	—	-1.8	-1.5
Muriate of potash ..	+2.8	-0.2	+5.8	+3.1	+2.5	+0.4	+5.2	+2.7	+3.0	—	—

**Interaction of spacing and muriate of potash.**

Spacing	GRAIN : cwt. per acre		STRAW : cwt. per acre	
	None	1.0 cwt. K <sub>2</sub> O	None	1.0 cwt. K <sub>2</sub> O
18 inches ..	22.6	22.2	28.7	28.5
24 inches ..	16.7	22.6	21.1	26.9

STANDARD ERRORS : Grain :  $\pm 1.20$ . Straw :  $\pm 1.26$ .

**Conclusions**

The 18-inch spacing gave significantly higher yields of both grain and straw than the 24-inch spacing. The responses to dung were both significant, that for grain being 5.6 cwt. per acre or 26.7 per cent. of the mean yield. The increases due to nitro-chalk were not significant. Superphosphate produced slight, though not significant, decreases in yield. The response to muriate of potash was significant in the case of grain and almost significant in the case of straw. This effect, however, appeared only with the 24-inch spacing, the interaction between muriate of potash and spacing being significant for both grain and straw.

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